Space Weather Technical Forecast

Issued on Friday, 26 August 2022 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active fluence likely persisting for another day. Chance of Moderate flares (R1-R2 Radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has become Moderate, with an increasing number of C-class flares and two M-class flares, the largest being an M1.8 observed at 25/1951 UTC, originating from AR3089. There are seven sunspot regions on the visible side of the disc, two of which are small, simple and fading in the northeast. The largest and most complex region is AR3088 in the southwest. This region continues to grow in size and remains unusually aligned north to south, now classified as Dkc/Beta. AR3085 is now a mature and rather passive region. AR3086 has now started to decrease and lost its intermediate spots. AR3087 is now a simple unipolar group. Another region worth of note is AR3089; it is increasing in size and complexity, with proliferation of spots on its trailing side. No Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, has been rather erratic in the last 24 hours, fluctuating between 400 and 330 km/s, most likely due to a very low, below average density. The total magnetic field strength (IMF) Bt, was weak, between 5-7nT, with small fluctuations in the Bz component. The phi angle was negative (towards the Sun). Resulting geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, was at Background levels. The high energy electron flux (greater than 2 MeV) remained at High levels, with a peak of 2800 pfu at 25/1845 UTC. The 24-hour integrated electron fluence remained above the Active threshold (1e8 integrated pfu) throughout the period, displaying a relatively flat trend. A value of 1.77e8 integrated pfu was observed at 26/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are likely, with a slight chance of an X-class flare, most likely from either AR3089 in the southeast or AR3088 in the southwest.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in this forecast. Solar winds are at slow-ambient levels but are expected to become slightly enhanced on day 2, reaching 400-450km/s. Another, more significant enhancement should follow on day 4, under the influence of a coronal hole high speed stream, with speeds reaching 500-550km/s. Geomagnetic activity is expected to be mostly Quiet with isolated Unsettled or Active intervals on days 1-3, but Quiet to Unsettled with Active intervals and a slight chance of a G1/Minor Storm on day 4 (29th).

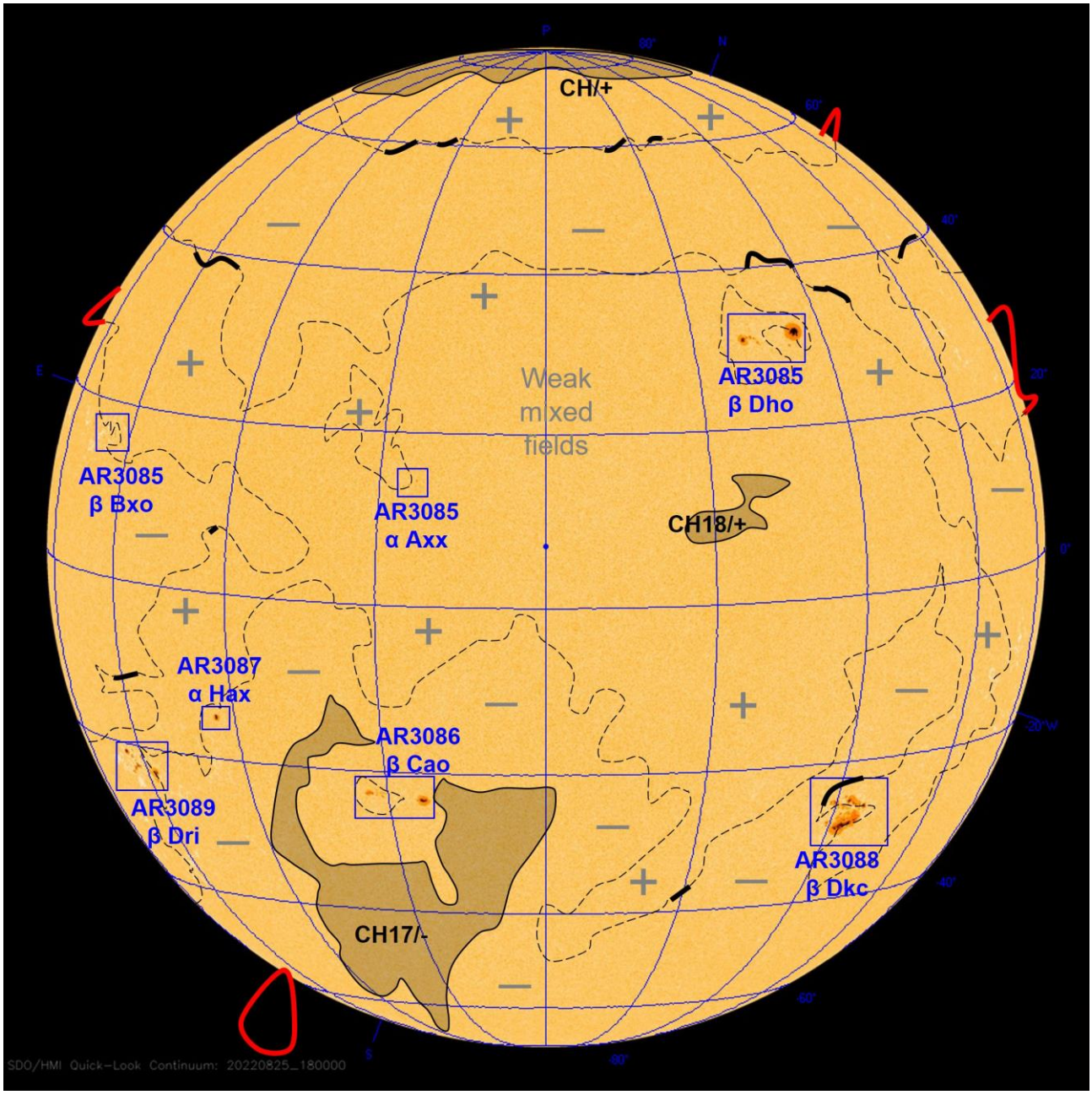
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is forecast to remain at Background levels but carries a slightly raised risk of an S1, due to the presence of two rather complex sunspot regions, namely AR3088 and AR3089. The high energy electron flux (greater than 2 MeV) is currently at High levels but is expected to see a decrease in

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

peak values to finally drop to background and moderate levels. Consequently the associated active 24-hour fluence is expected to continue to show a decreasing trend, likely dropping back below the 1e8 threshold by the end of the 26th (Day 1) or early 27th (day 2) based on the current trend.

Figure 1. Solar Analysis Valid 25/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No CMEs have been assessed as Earth-directed for this period.

Solar winds are currently at slow-ambient levels but are expected to become slightly enhanced on day 2 (27th), under the influence of the high speed stream originating from CH18/+. Data gathered from Stereo A Mag & Plastic shows the arrival of a high speed stream with speeds around 400-450 km/s soon after 25/0900 UTC, which would correspond to an arrival at Earth in the UTC morning of the 27th. However this coronal hole is a recurring feature that achieved very little in terms of geomagnetic activity on the last rotation and despite being slightly larger this time round, its impact is expected to remain small, with isolated Unsettled or Active intervals likely.

The next coronal hole worth of note is CH17/- and is expected to become geoeffective in the late UTC hours of day 4 (29th). This feature is much larger than CH18 but also further away from Earth, and so confidence is not great with the strength of the connection. Solar wind speeds may be able to reach 500 km/s, allowing a chance of Active intervals and a slight chance of a G1/Minor Storm interval.

Overall geomagnetic activity is expected to be mostly Quiet with isolated Unsettled or Active intervals on days 1-3, but Quiet to Unsettled with Active intervals and a slight chance of a G1/Minor Storm on day 4 (29th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	0	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

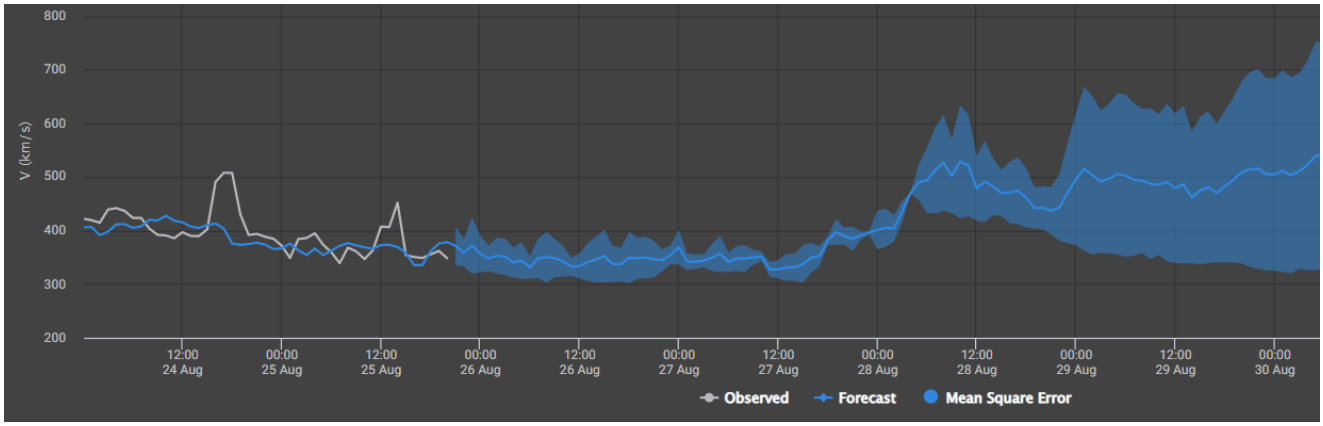
Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 2: SWPM (Solar Wind Persistence Model), considered to provide good guidance although 28th enhancement is thought to be too early



Radio Blackouts - X-Ray Flares:

Solar activity has become Moderate, with an increasing number of C-class flares and two M-class flares, the largest being an M1.8 observed at 25/1951 UTC, originating from AR3089. Further M-class flares are likely, with a slight chance of an X-class flare, most likely from either AR3089 in the southeast or AR3088 in the southwest.

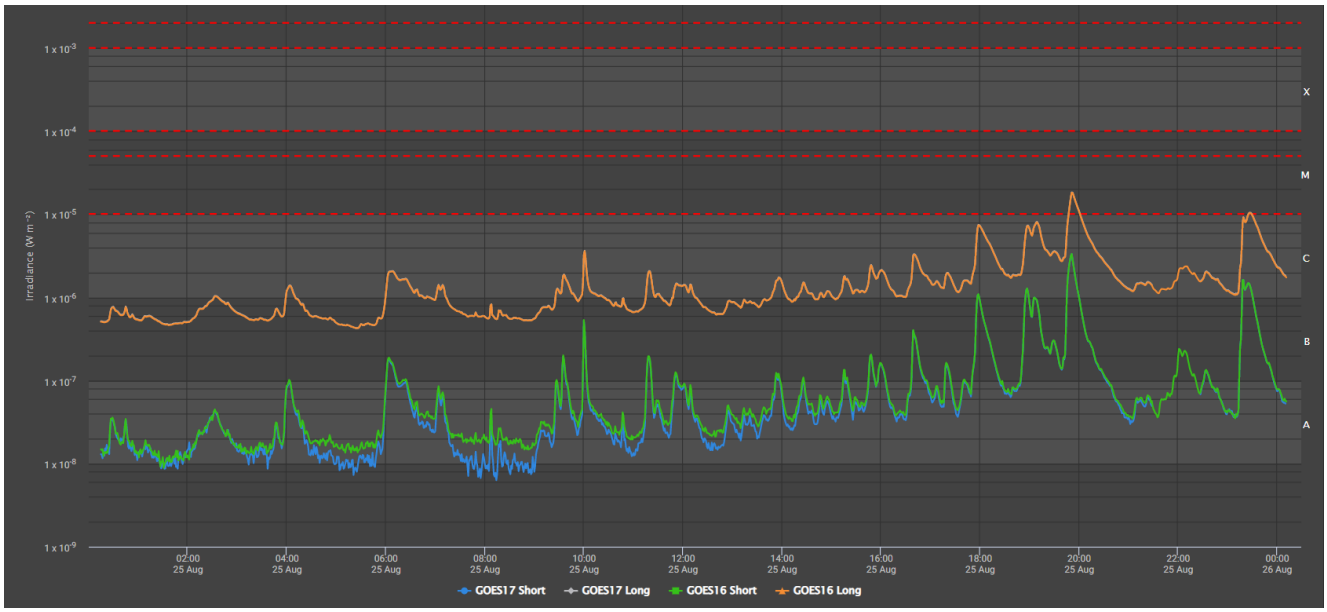
There are seven sunspot regions on the visible side of the disc, two of which are small, simple and fading in the northeast. The largest and most complex region is AR3088 in the southwest. This region continues to grow in size and remains unusually aligned north to south, now classified as Dkc/Beta. AR3085 is now a mature and rather passive region. AR3086 has now started to decrease and lost its intermediate spots. AR3087 is now a simple unipolar group. Another region worth of note is AR3089; it is increasing in size and complexity, with proliferation of spots on its trailing side. .

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: Latest X-ray Flares, as observed at GOES-16

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels. However the probability of an S1 has been increased slightly in the wake of the M-class flare originating from AR3089. AR3088 is also a region that needs to be monitored, particularly as it continues to develop while transiting across the southwest hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

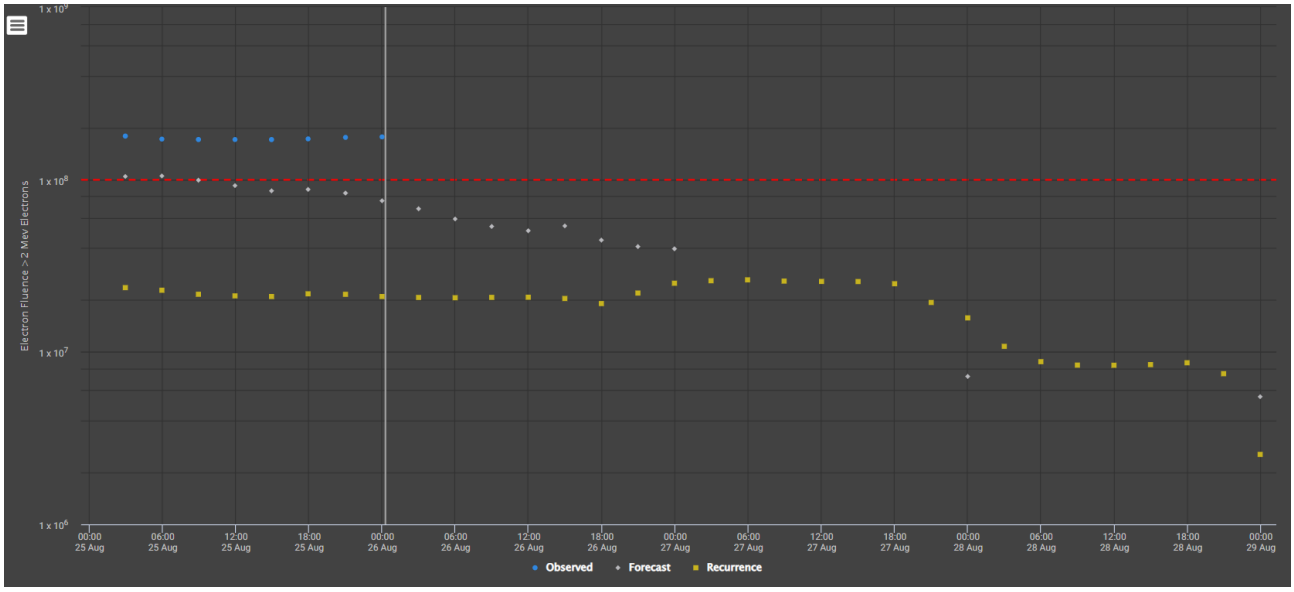
© Crown Copyright 2022. All Rights Reserved.

High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux as measured by GOES-16 is currently High after recent coronal hole enhancements. With no further enhancements expected which could potentially drop the electron counts, only a gradual reduction in peak values is likely. The electron flux should eventually drop to background and moderate levels perhaps by day 1 (26th) but probably not until day 2 (27th) although confidence is low with regards to timings.

The associated fluence is expected to reflect this decreasing trend, likely remaining Active (above 1e8 pfu) into day 1 (26th), before coming back below threshold soon after. While the trend of the fluence depicted by the Met Office REFM output is accepted, it is clearly under-estimating the electron flux at this stage and should only be considered as a guide.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	50	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Latest REFM output



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.